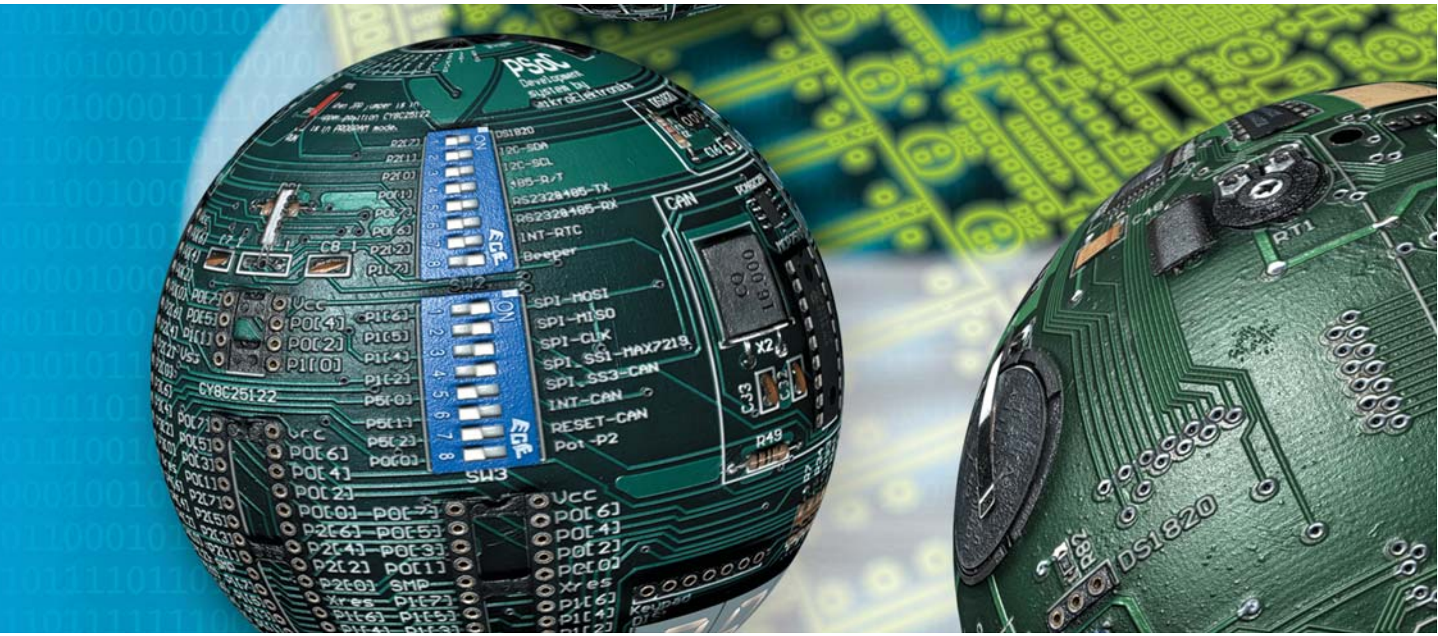
SOFTWARE AND HARDWARE SOLUTIONS FOR THE EMBEDDED WORLD

MikroElektronika
Development tools - Books - Compilers

EASYdsPIC4 User's Manual



3 in 1

mikro ICD IN-CIRCUIT DEBUGGER

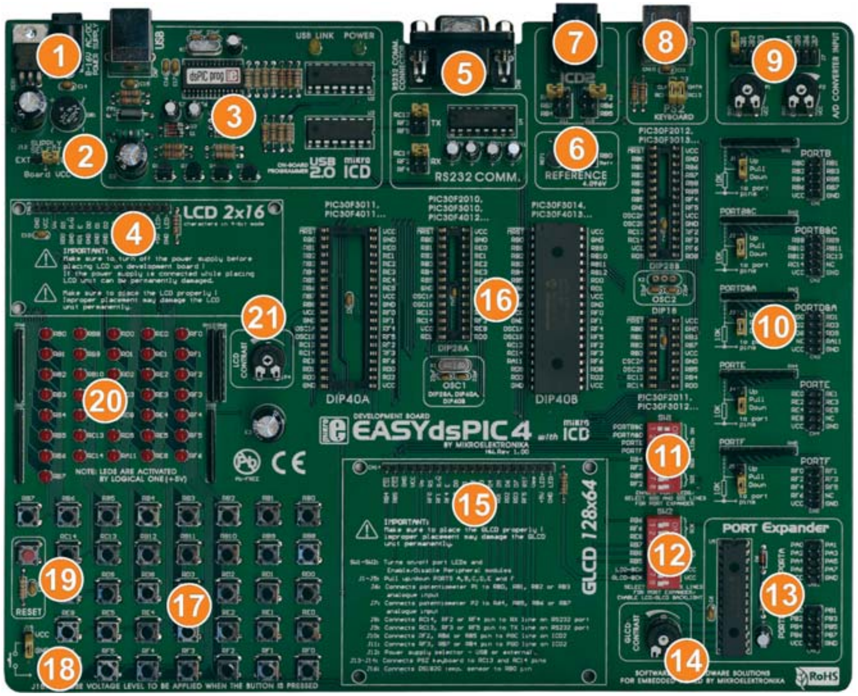
USB 2.0 IN-CIRCUIT PROGRAMMER

MICROCHIP dsPIC DEVELOPMENT BOARD

With useful implemented peripherals, plentiful practical code examples and a broad set of additional add-on boards (Serial Ethernet, Compact Flash, MMC/SD, ADC, DAC, CAN, RTC, RS-485, etc.), MikroElektronika development boards make fast and reliable tools that can satisfy the needs of experienced engineers and beginners alike.

Software and Hardware solutions for Embedded World

EASYdsPIC4 KEY FEATURES



1. External power supply from 8 to 16 V AC/DC;
2. Choose between external and USB power supply. When powering from your PC's USB port, you don't need an external supply;
3. Very fast and flexible USB programmer on board with mikroICD (In-Circuit Debugger). The key feature is expanability. By downloading new software, you will be able to program new MCUs in coming years;
4. You can connect LCD if you need it for your application in 4-bit mode;
5. RS232 communication port;
6. 4.096V voltage reference is used for working with A/D Converter;
7. ICD2 connector;
8. PC keyboard connector;
9. For the purpose of presentation all PORTB pins are connected to potentiometers P1 and P2 and can be used to measure voltages set by these potentiometers;
10. If jumper is set to the upper position the pins of appropriate port are set to logical one (pull-up). If jumper is set to the lower position, the pins are set to logical zero (pull-down). It is very important to select pull-up for port if you expect logical zero on its inputs and vice versa;
11. The first four switches on SW1 are used to enable or disable LEDs connected to MCU pins. Switches 5 and 6 are used to select SDO line and switches 7 and 8 to select SDI line.;
12. Switches 1, 2 and 3 on SW2 are used to select the SCK line. Switches 4,5 and 6 are used to select the CS line. Switch number 7 is used to enable the LCD backlight, and switch number 8 to enable the GLCD backlight;
13. Port Expander;
14. Set GLCD contrast according to your display characteristics;
15. You can connect Graphic LCD if you need it for your application or LCD in 8-bit mode;
16. MCU Card sockets
17. 36 buttons enable you to control every pin on your microcontroller;
18. You can choose how to affect pin by pressing button, high state or low state.
19. Reset circuit - if the reset button is pressed a hardware reset will take place (MCU will start executing from the beginning).
20. See all the signals - each pin has a LED;
21. Set LCD contrast according to your display characteristics;

Development board dimensions

Width	250 mm	9.84 Inches
Height	210 mm	8.27 Inches

CONTENTS

CONNECTING THE SYSTEM

The development system box contains the development system, product CD, USB cable, RS232 cable and this manual.

Step no.1 The first thing to do is to take the system out of the box. Unpack the USB cable and connect it to the PC. Please use USB ports on the back of the PC with direct connection to the motherboard.

Step no.2 Install the dsPICFLASH programmer and drivers. Start the installation from the product CD: CD_Drive:\product\zip\dsPICFlash_setup.exe.

Step no.3 After the installation connect the USB cable to the EASYdsPIC4 board. You will be asked for the dsPICFLASH drivers. Point to them in order to finish the driver installation. They are placed in the folder:
System_Drive:\Program Files\Mikroelektronika\dsPICFLASH-mikroICD\Driver.NT

Step no.4 Run and use dsPICFLASH as explained in the document '*dsPICflash with mikroICD support*':
CD_Drive:\product\pdf\dspicflash_manual.pdf.

After these 4 steps, your EASYdsPIC4 is installed and ready for use. You can try to read a program from the chip or to load an example from the examples folder of mikroElektronika's compilers for dsPIC or from the product CD:
CD_Drive:\product\zip\EASYdsPIC4_examples.zip.

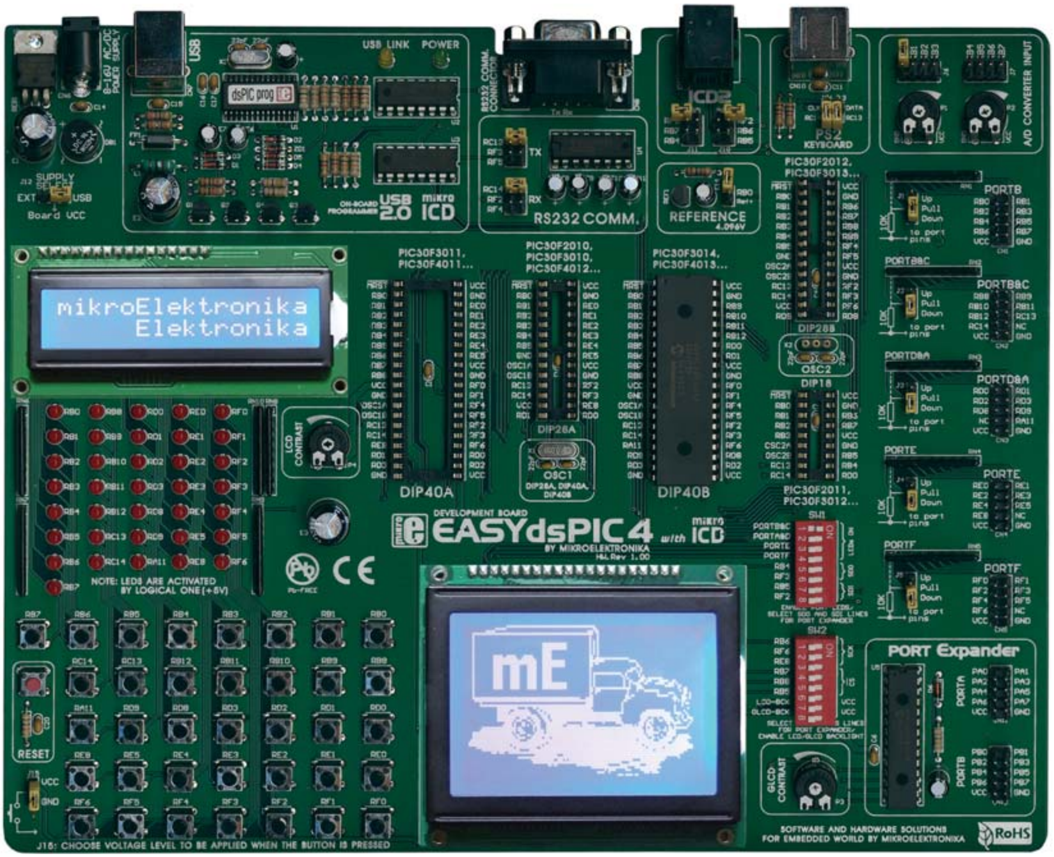
MICROCHIP dsPIC DEVELOPMENT BOARD

INTRODUCTION

The EASYdsPIC4 development system is a full-featured development board for Microchip dsPIC microcontrollers. It has been designed to allow students and engineers to easily exercise and explore the capabilities of dsPIC microcontrollers. It allows dsPIC microcontrollers to be interfaced with external circuits and a broad range of peripheral devices, allowing the user to concentrate on software development.

Figure 1 illustrates the development board. On a silkscreen, there are identification marks next to each component. These marks describe connections to the microcontroller, operation modes and provide other useful notes. The need for additional schematics is minimized as all relevant information is printed on the board.

EASYdsPIC4 development board **Figure 1.**



SWITCHES

The EASYdsPIC4 development board features a number of peripherial devices. In order to enable these devices before programming, you need to check if appropriate jumpers or switches have been properly set.

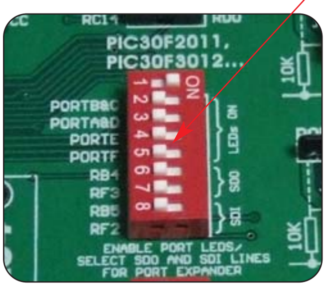
Switches are devices that have two positions - ON and OFF, which have a role to establish or break a connection between two contacts. The EASYdsPIC4 development board has two groups of switches.

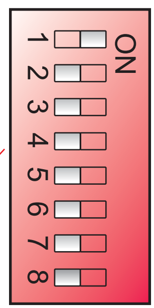
The upper four switches of SW1 are used to enable LEDs connected to PORTB/C, PORTA/D, PORTE and PORTF. For example, if the switch for PORTB is OFF, all PORTB LEDs will be turned off. Switches 5 and 6 of SW1 are used to enable SDO(Serial Data Output) and switches 7 and 8 to enable SDI (Serial Data Input).

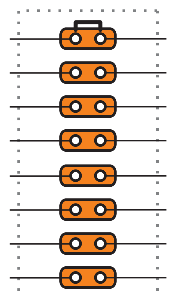
The first two switches of SW2 are used to enable SCK, switches 3, 4 and 5 are used for enabling CS (Chip Select) lines. Witches 7 and 8 are used to enable LCD Backlight and GLCD Backight respectively.

Figure 2.

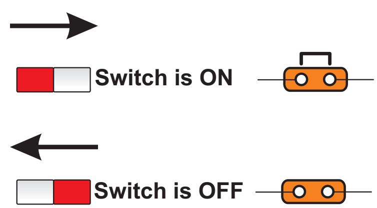
Group of 8 switches







Switch 1 is ON, and other switches are OFF

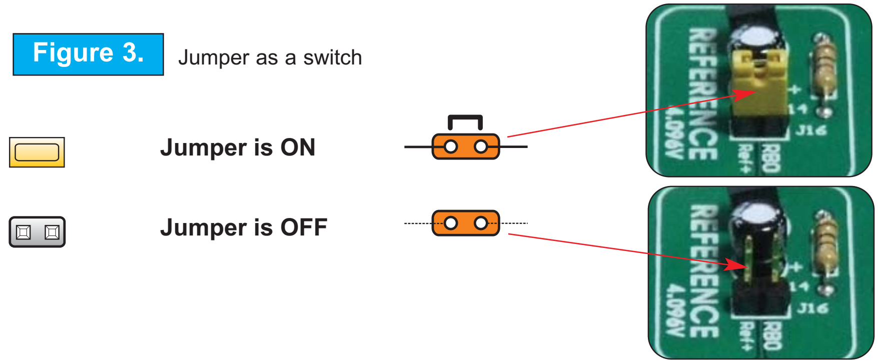


JUMPERS

Jumpers, like switches, can break or establish a connection between two points. Beneath the plastic cover of the jumper is a metal contact, which makes a connection if the jumper is placed between two disconnected pins.

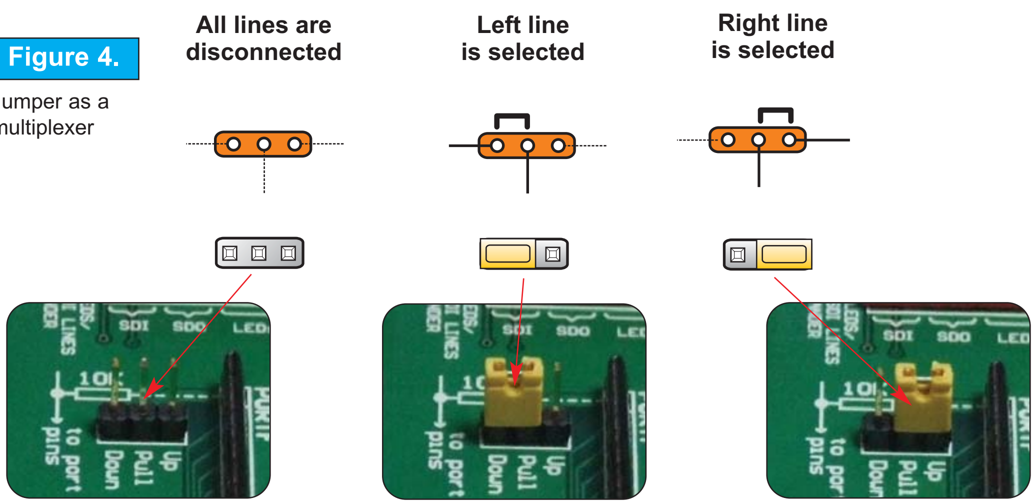
For example, jumper J16 is used as switch. It is used to connect the 4.096V voltage reference to the microcontroller's RB0 pin. A connection is made when the jumpers are placed between two contacts.

Figure 3. Jumper as a switch



More often jumpers are used as a selector between two possible connections by using a three pin connector. As illustrated in Fig. 4, the middle contact can be connected to the left or right pin, depending on the jumper's position.

Figure 4. Jumper as a multiplexer



MCU SOCKETS

EASYdsPIC4 is delivered with a PIC30F4013, 40-pin microcontroller. Users can remove this one and fit a different microcontroller in DIP40, DIP28, DIP28, DIP18 packages. There are two different sockets for 40-pin MCUs (DIP40A and DIP40B). There are also two sockets for 28-pin MCUs (DIP28A and DIP28B).
For example,PIC30F4013 should be placed in DIP40B socket and PIC30F4011 should be placed in DIP40A socket.

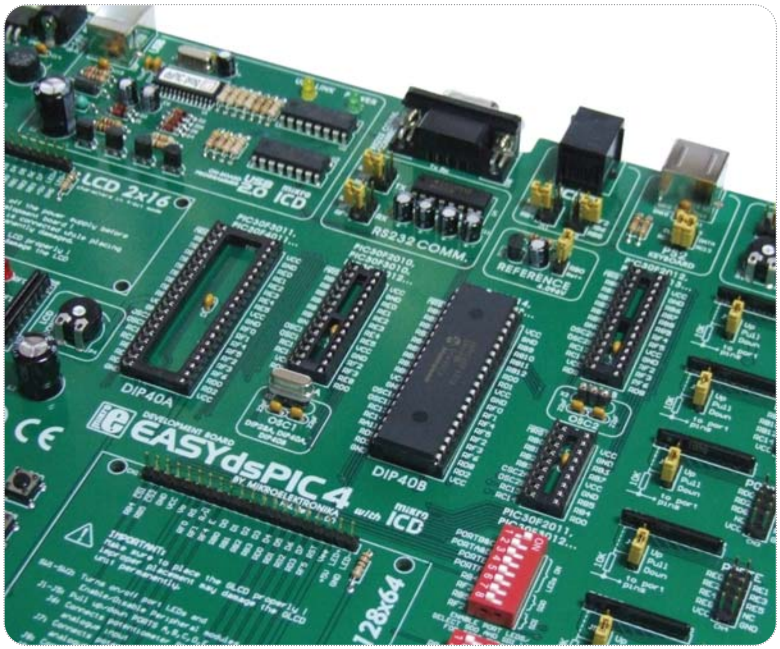


Figure 5. MCU sockets

Note: Since all packages have parallel connections, there must not be more than one microcontroller on the board at a time.

Note: If you use DIP28A, DIP40A, or DIP40B MCU socket, use OSC1 oscillator socket. If you use DIP28B or DIP18 MCU socket, use OSC2 oscillator socket.

Microcontroller's pins are routed to various peripherals as illustrated in Fig. 6. All ports have direct connections to Direct Port Access connectors. Such connectors are typically used for connecting external peripherals to the board or for providing useful points for connecting digital logic probe.

All ports are connected to LEDs, push-button switches and pull-up/down resistors, which allow easy monitoring and testing of digital pin state .

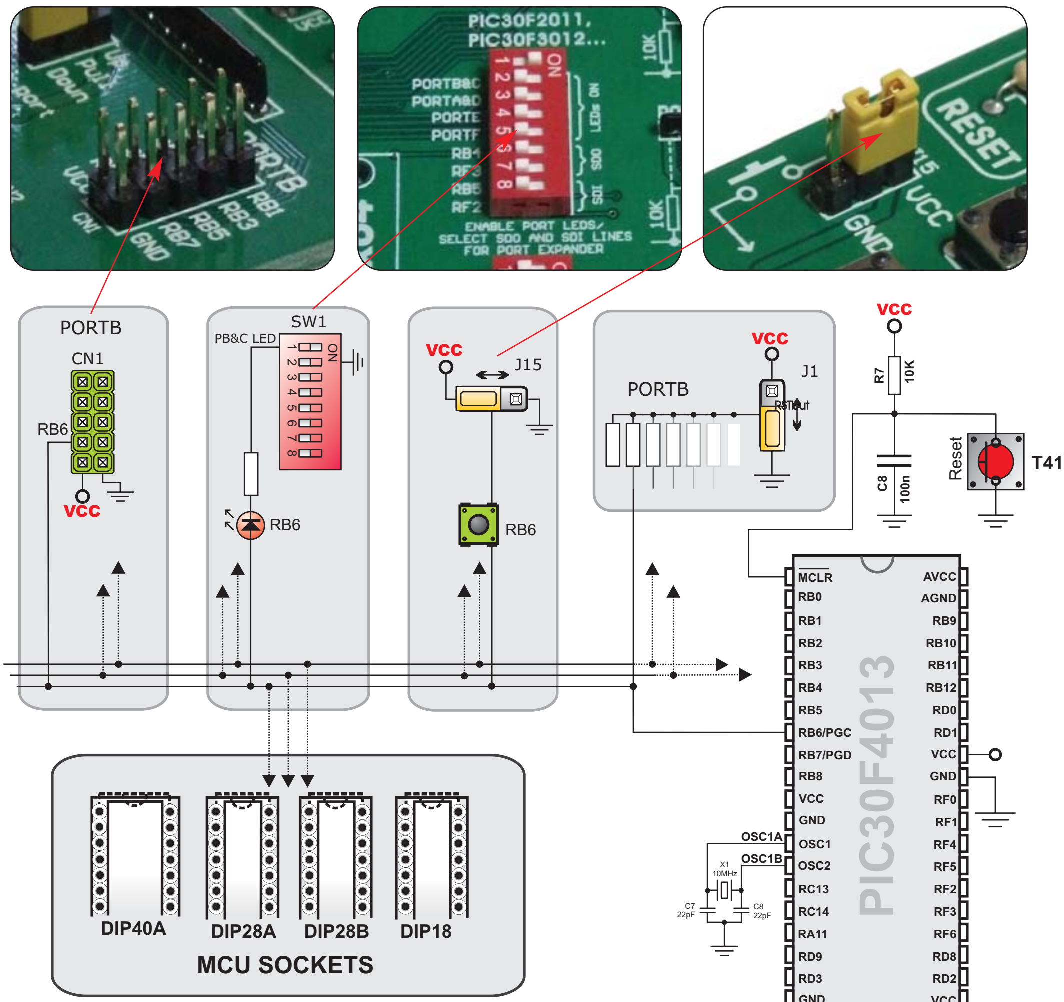


Figure 6. System connection

POWER SUPPLY

POWER SUPPLY

POWER SUPPLY SELECTABLE

As a power supply source, users can select either a regulated supply from the USB cable (default) or an external power supply. In case of the USB power supply, the system should be connected to a PC using the USB programming cable, while the jumper J12 should be set in the right-hand position.

In the case of an external power supply, the EASYdsPIC4 board produces +5V using an LM7805 voltage regulator. The external power supply can be AC or DC, with a voltage between 8V and 16V and the jumper J12 should be set in the left-hand position. In Fig. 7 you can see USB and external power supply connectors.

Figure 7. USB and power supply connectors



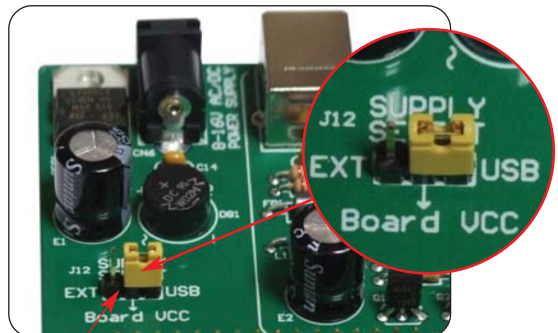
USB connector

External power supply connector

J12 in the left-hand position: system will take power from the external AC/DC power adapter.

J12 in the right-hand position: system will take power from the USB cable.

Figure 8. Power supply select jumper



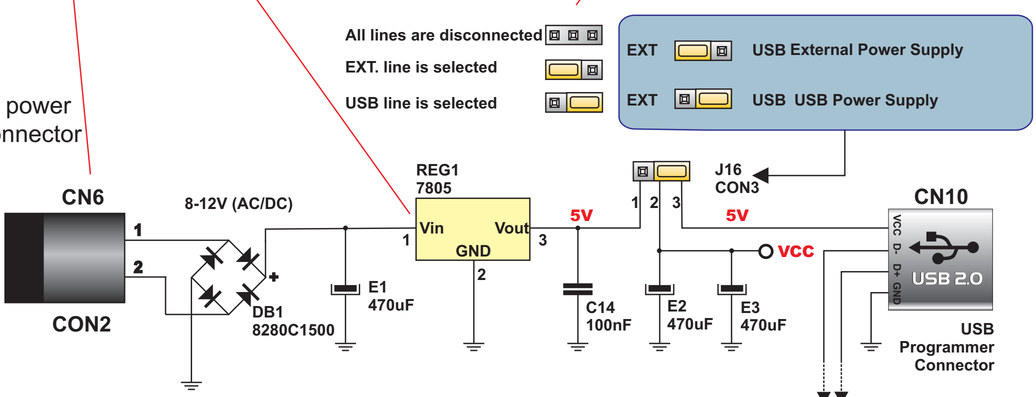


Figure 9. JP16 is set to USB power supply

ON-BOARD USB 2.0 PROGRAMMER

There is no need for the use of external equipment during programming as EASYdsPIC4 development system has its own on-board USB programmer. All you need to do is connect the system to a PC using USB cable. Then, load your program into the microcontroller via the ds*PICflash* programming software which is supplied with EASYdsPIC4.

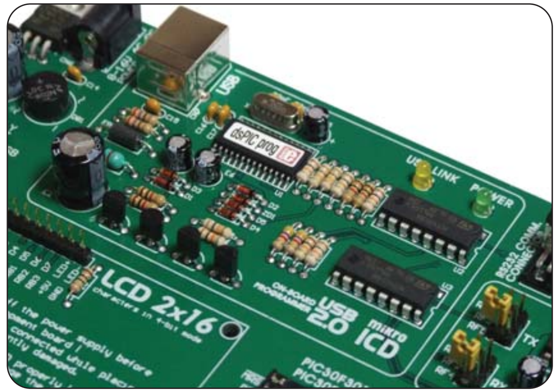


Figure 10. USB 2.0 programmer



Note: There is no need for reseting MCU after programming. The programmer will reset the MCU automatically.

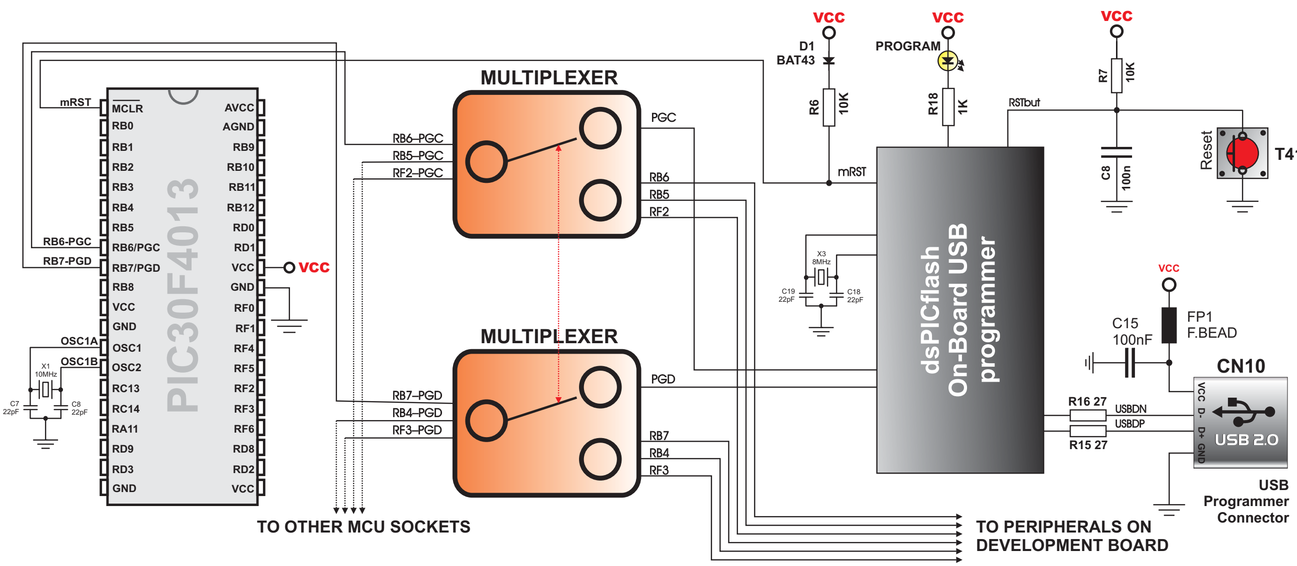


Figure 11. USB 2.0 programmer schematic

LEDs

Light Emitting Diodes (LEDs) are the most commonly used components, usually for displaying pin's digital state. EASYdsPIC4 has 36 LEDs that are connected to the microcontroller's PORTB, PORTC, PORTD, PORTE and PORTF.

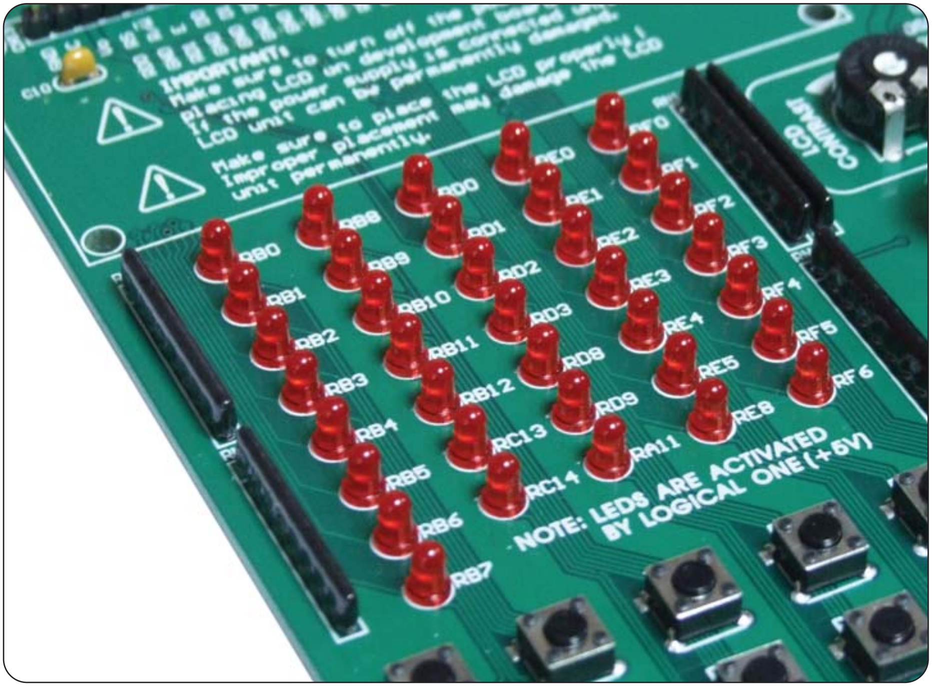
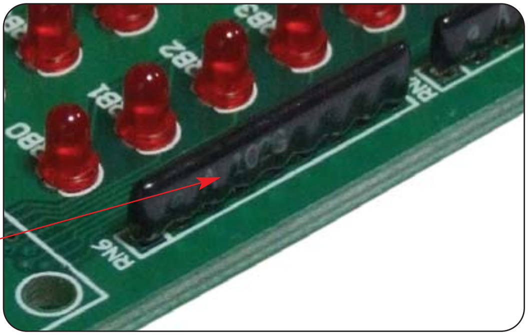


Figure 12. Light Emitting Diodes

Each group of LEDs can be enabled or disabled using the switch SW1. The first switch enables LEDs on PORTB and PORTC, the second switch enables LEDs on PORTA and PORTD. Switches 3 an 4 are used to enable LEDs connected to PORTE and PORTF respectively.

Fig. 13. illustrates the connection of a LEDs connected to PORTB of the microcontroller. A resistor is used in series with the LED to limit the LED's current. In this case the resistor's value is 1K.

The LEDs are enabled when the corresponding switch on SW1 is on. When enabled, LEDs will display the state of the corresponding microcontroller pin; otherwise the LEDs will always be off, no matter what the port state is, as no current can flow through LED.



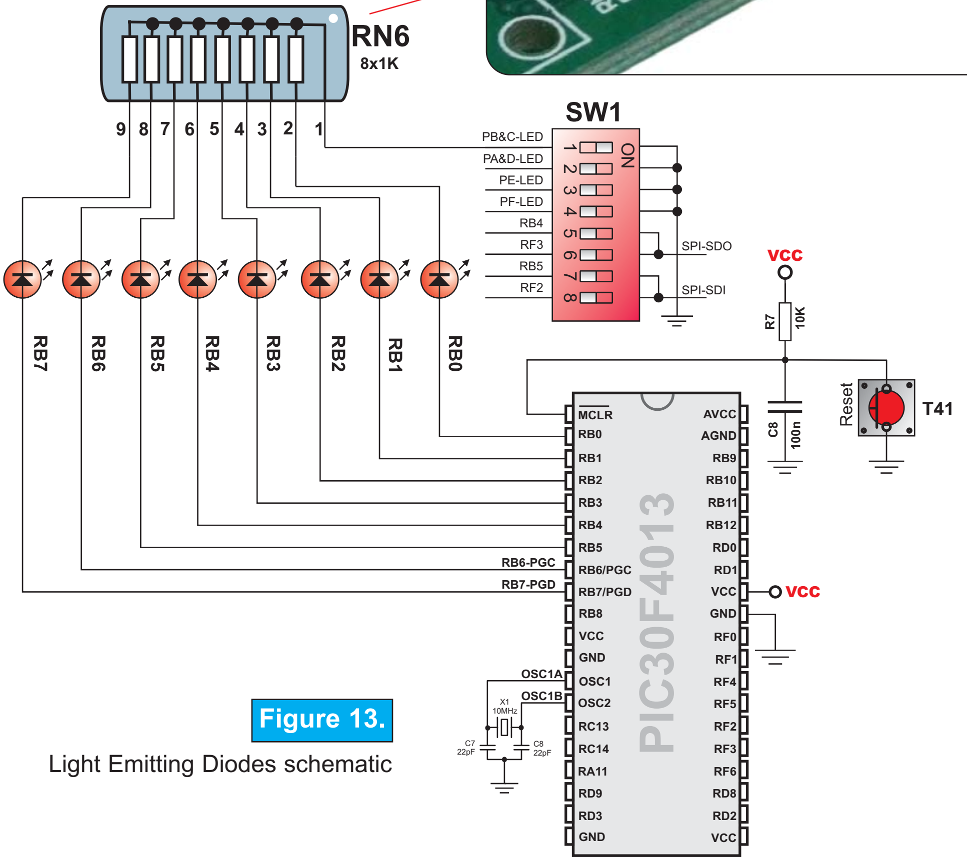


Figure 13.

Light Emitting Diodes schematic

PUSHBUTTON SWITCHES

PUSHBUTTON SWITCHES

EASYdsPIC4 has 36 push buttons, which can be used to change states of digital inputs to microcontroller's ports. There is also one switch that acts as a RESET. Reset switch schematic is shown in Figure 14.

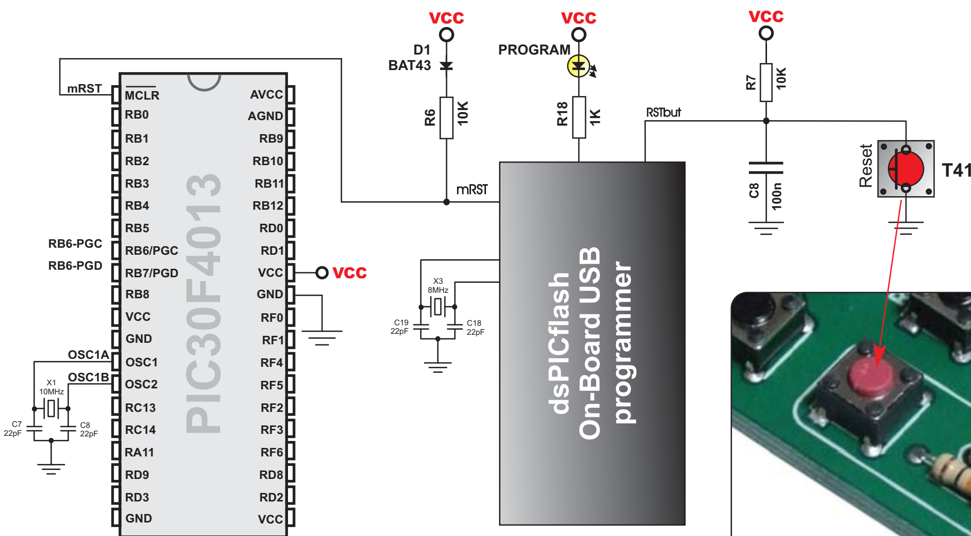


Figure 14. Reset switch schematic



Reset switch Figure 15.

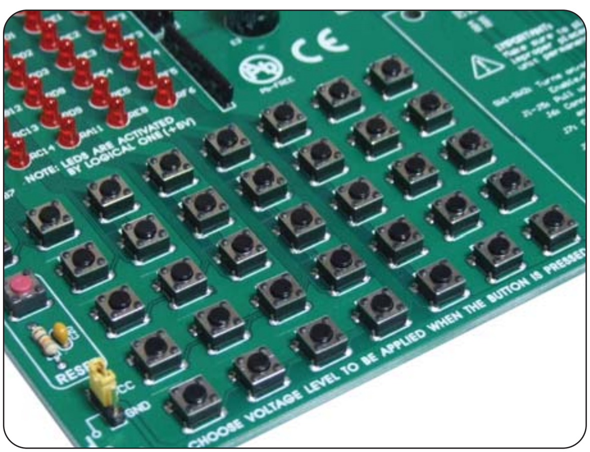


Figure 16. Pushbutton switches

Buttons connections to PORTA, PORTB, PORTC, PORTD, PORTE and PORTF are shown in Fig. 17. Jumper J15 determines whether a button press will bring logical zero or logical one to the appropriate pin.

When button is not pressed, pin state is determined by the pull-up or pull-down port jumpers.

In the example shown in Fig. 17, J15 is connected to +5V, therefore pressing the buttons will bring logical one to the appropriate pins.

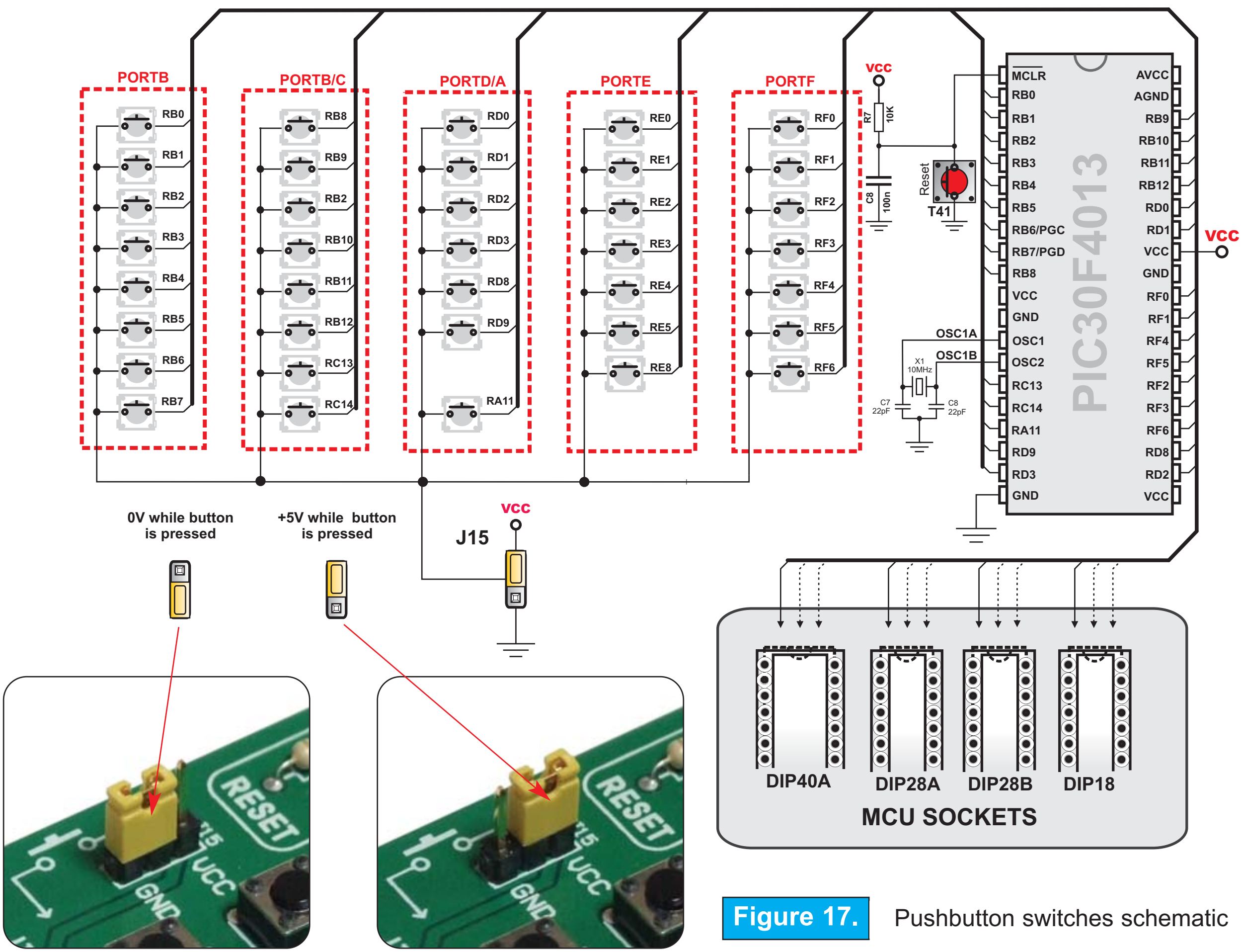


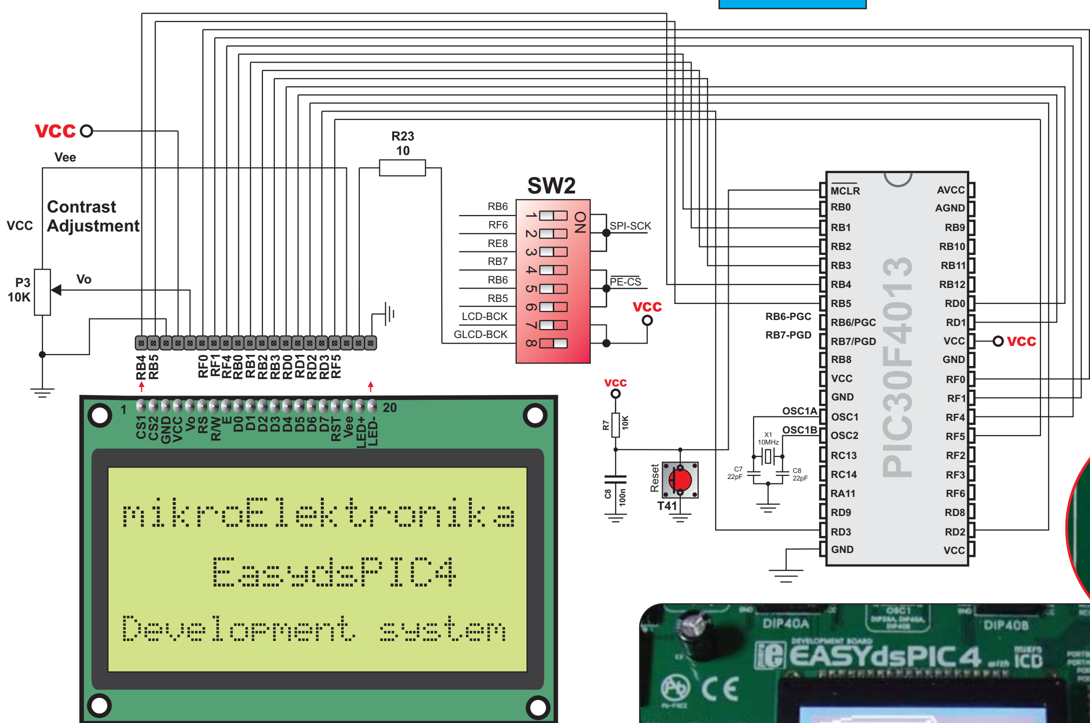
Figure 17. Pushbutton switches schematic

GRAPHIC LCD CONNECTOR ON-BOARD

GRAPHIC LCD

A graphic LCD (GLCD) allows advanced visual messages to be displayed. While a character LCD can display only alphanumeric characters, a GLCD can be used to display messages in the form of drawings and bitmaps. The most commonly used graphic LCD has the screen resolution of 128x64 pixels. The GLCD's contrast can be adjusted using the potentiometer P3, which is placed to the right of the GLCD. GLCD backlight can also be turned on or off using the switch 8 of switch group SW2.

Figure 18. GLCD schematic



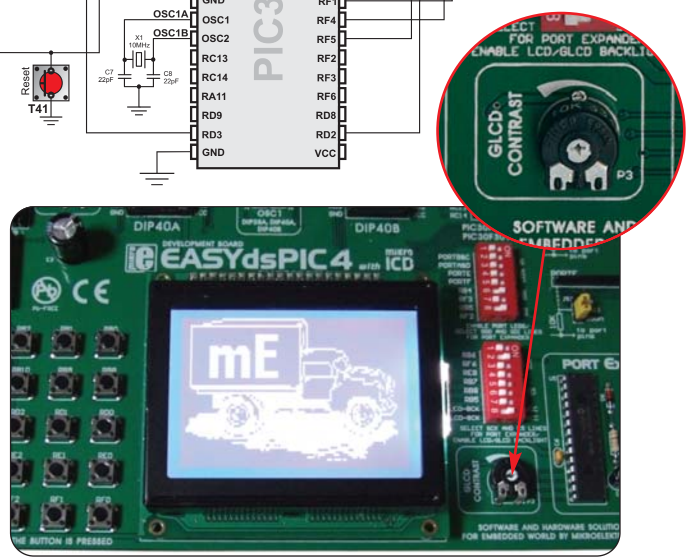


Figure 19. GLCD

LCD 2X16 IN 4-BIT MODE

The standard character LCD is probably the most widely used data visualization component. Usually, it can display two lines of 16 alphanumeric characters, each character made up of 5x8 pixels. The character LCD communicates with the microcontroller via a 4-bit data bus. The connection to the microcontroller is shown in Fig. 21 where there are only four data lines. It is important that the LCD is only inserted or removed from the EASYdsPIC4 when the power is off. Potentiomenter P4 is used to adjust the LCD's contrast and switch 7 of switch group SW2 is used to turn on or off the LCD's backlight.

Figure 20. LCD



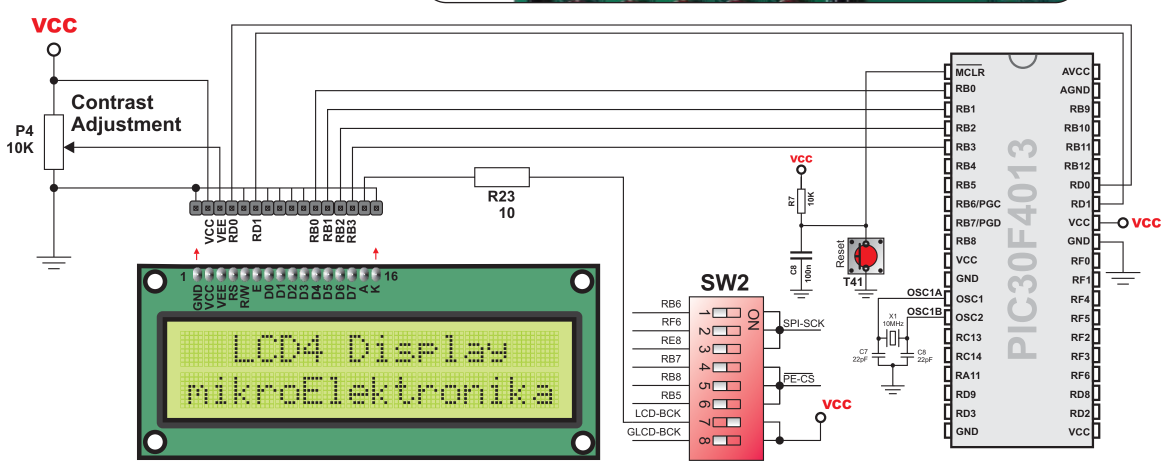


Figure 21. LCD Schematic

RS-232 COMMUNICATION

RS-232 communication enables point-to-point data transfer. It is commonly used in data acquisition applications, for the transfer of data between the microcontroller and a PC. Since the voltage levels of a microcontroller and PC are not directly compatible with each other, a level transition buffer such as the MAX232 must be used.
There are two jumper groups J8 and J9 for connecting MCU lines to MAX232 tranciever. Jumper J8 is used to connect RC14, RF2 or RF4 MCU pin to RX line on RS232 port . Jumper J9 is used to connect RC13, RF3 or RF5 MCU pin to TX line on RS232 port..

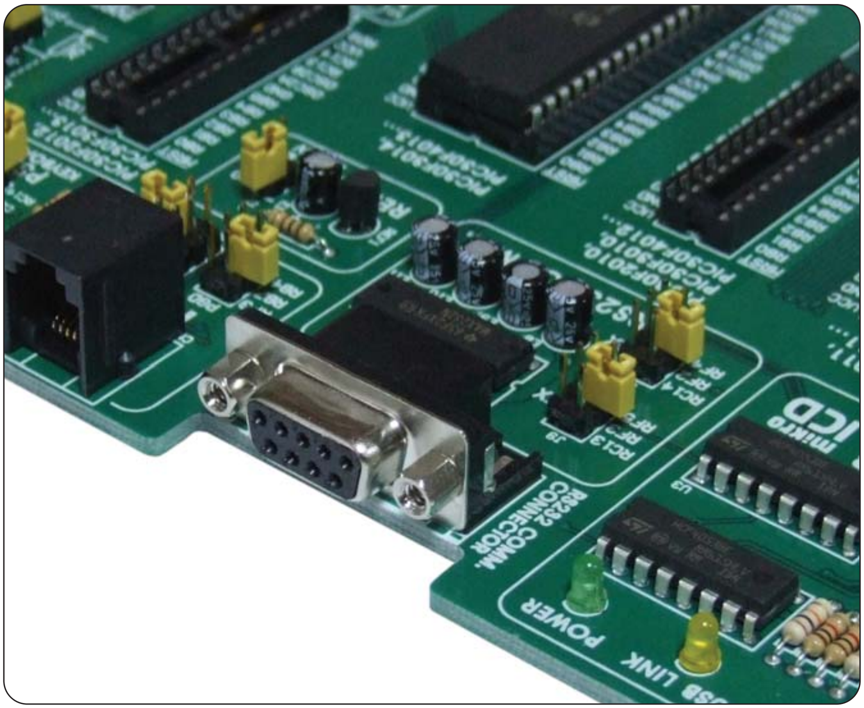


Figure 22. RS232 connector

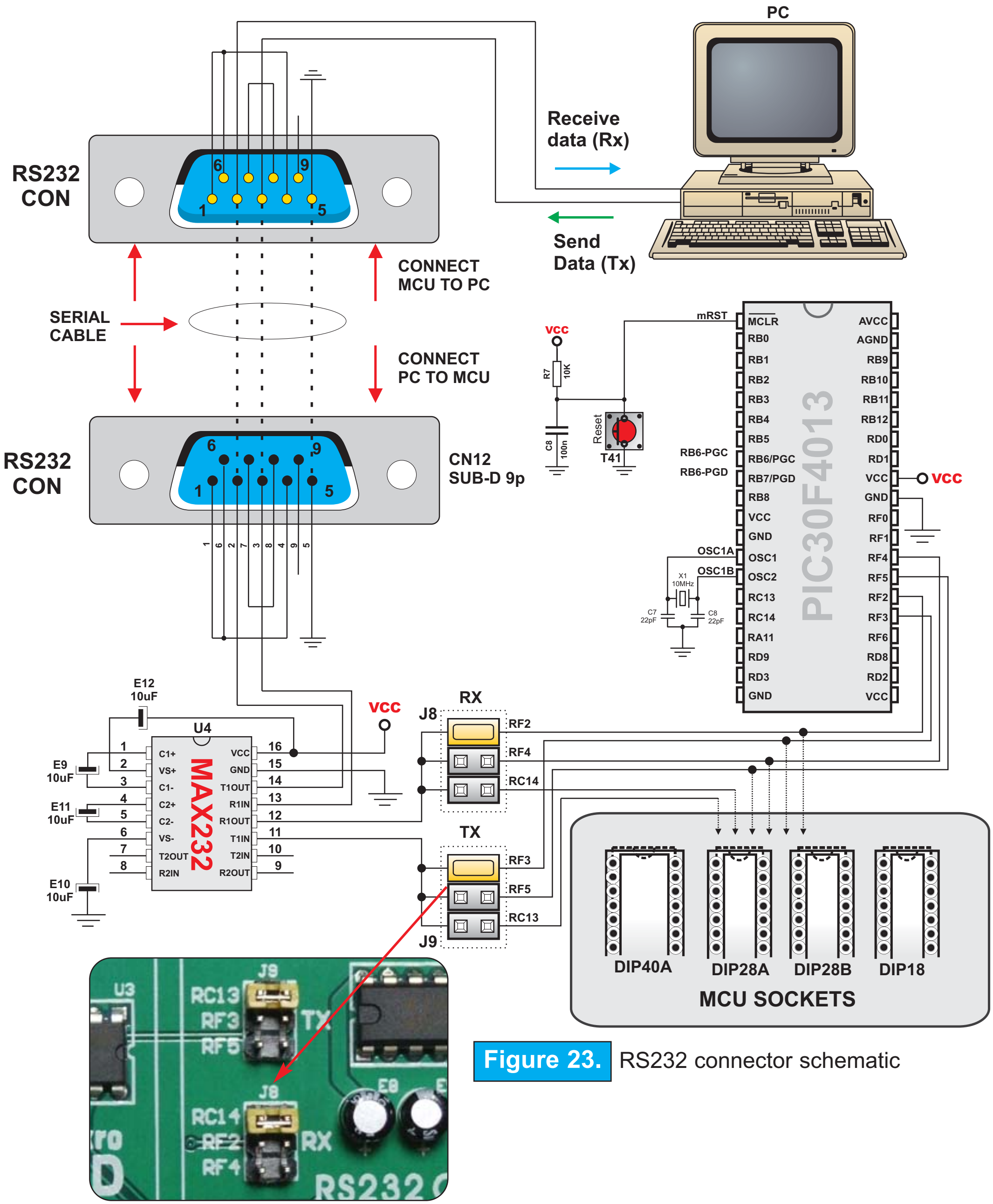


Figure 23. RS232 connector schematic

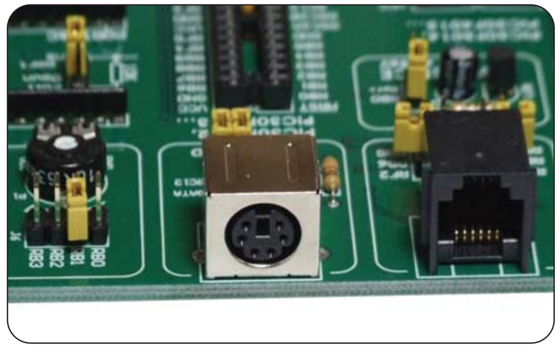
PS/2 COMMUNICATION

The PS/2 connector allows direct connection between EASYdsPIC4 and devices that use PS/2 communication, such as PC, keyboard or mouse. For example, the microcontroller can be connected to a keyboard to capture pressed keys or it can be connected to a PC to act as a keyboard. CLK and DATA lines are used for data tansfer. In this case, they are connected to pins RC14 and RC13 respectively.

Figure 25. Keyboard connected to development board



PS2 connector **Figure 24.**



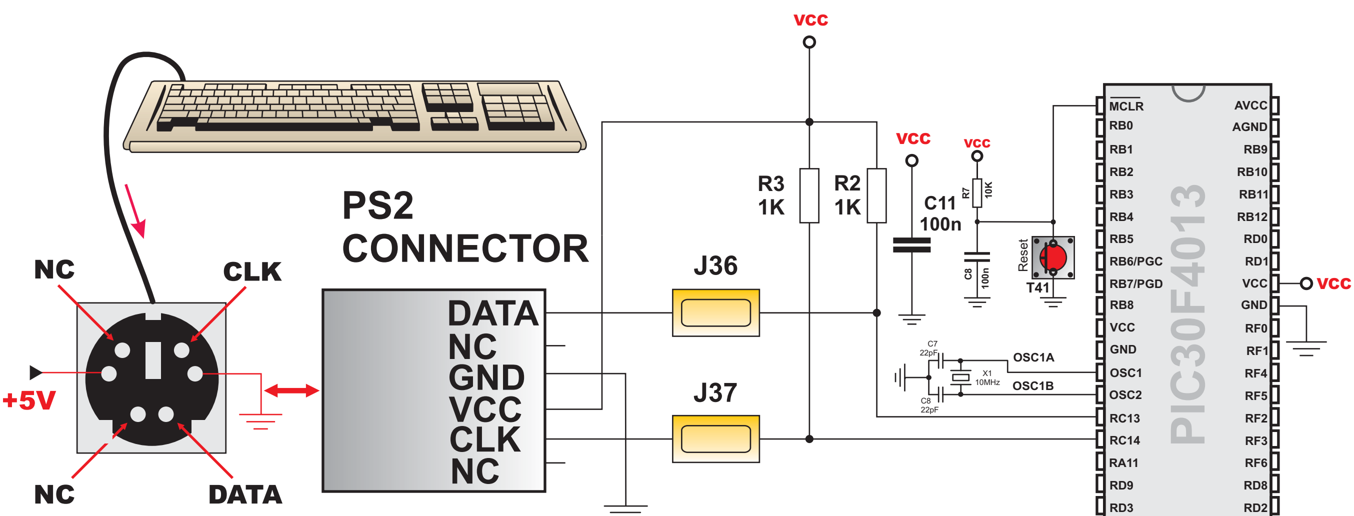


Figure 26. PS2 connector schematic

ADC INPUT ENABLED

A/D CONVERTER INPUT

EASYdsPIC4 development board has two potentiometers for working with Analog to Digital Converter (ADC). Both potentiometers outputs are in the range of 0V to 5V. Two analog signals can be connected on two different analog input pins at the same time. There are two jumper groups J6 and J7 for connecting MCU lines to potentiometers P1 and P2. Jumper J6 is used to connect RB0, RB1, RB2 or RB3 MCU pin to potentiometer P1. Jumper J7 is used to connect RB4, RB5, RB6 or RB7 MCU pin to potentiometer P2.

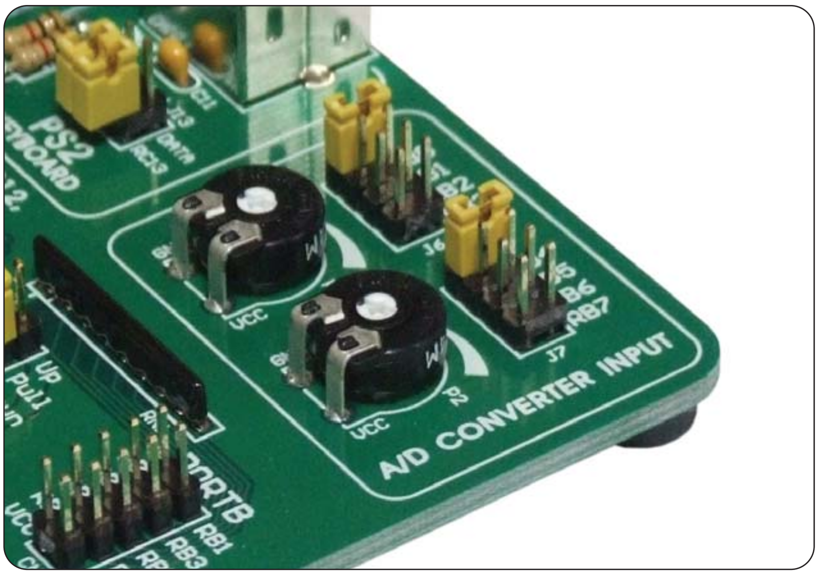
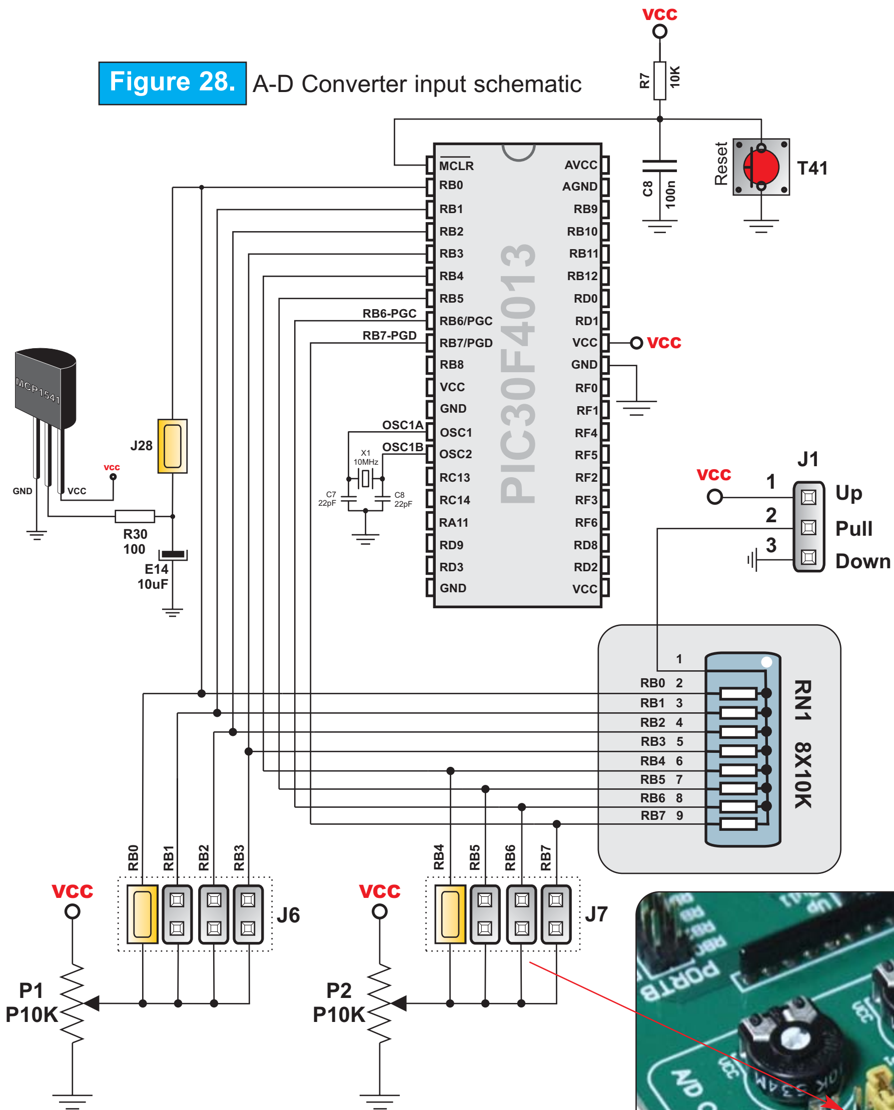


Figure 27. A-D Converter input

In order to measure analog signal without interference, turn the coresponding switch on SW1 to OFF position. This will disable connection from the used PORTB pin to the pull-up/down resistors.

Applications of A-D Conversion are various. Microcontroller takes analog signal from its input pin and translates it into a digital value. Basically, you can measure any analog signal that fits in range acceptable by dsPIC. That range is 0V to 5V.

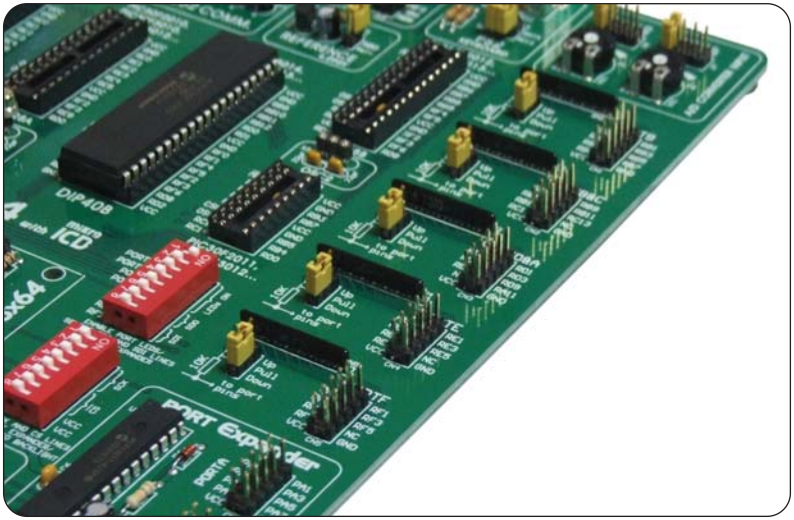
Figure 28. A-D Converter input schematic





DIRECT PORT ACCESS

All microcontroller input/output pins can be accessed via connectors placed along the right side of the board. Each port (PORTA, PORTB, PORTC, PORTD, PORTE and PORTF) can be accessed via 10-pin connector (IDC10) providing VCC and GND.



Direct port access connectors **Figure 29.**

These connectors can be used for system expansion with external boards such as Serial Ethernet, Compact Flash, MMC/SD, ADC, DAC, CAN, RTC, RS-485, etc. Ensure that the on-board peripherals are disconnected from microcontroller by setting the appropriate jumpers, while external peripherals are using the same pins. The connectors can also be used for attaching logic probes or other test equipment.

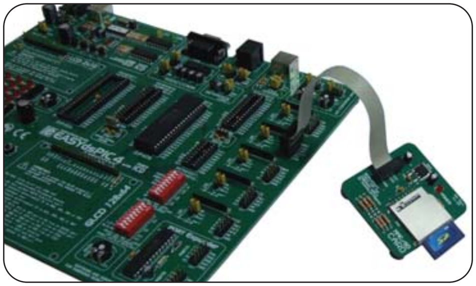


Figure 30.

Example of how to connect external peripheral with flat cable

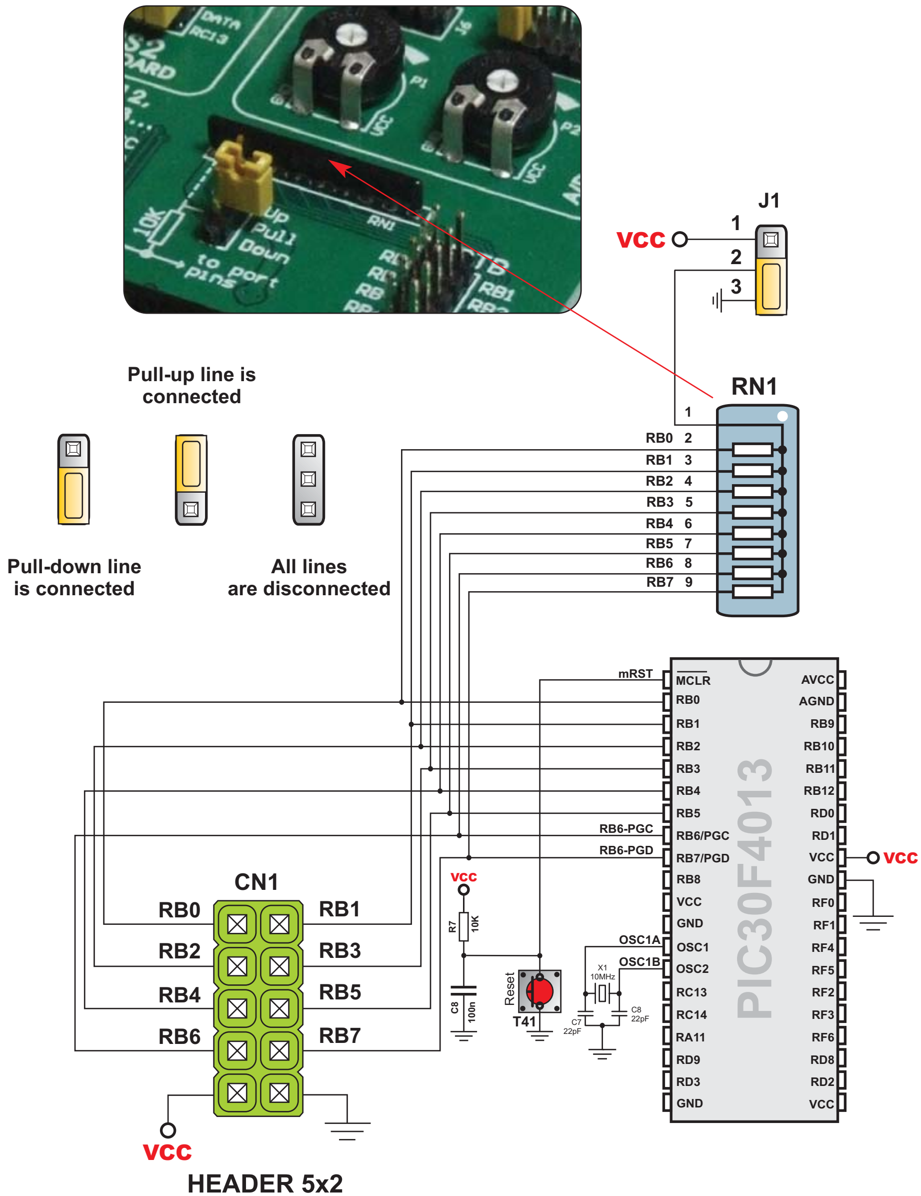


Figure 31. Direct port access schematic

PORT EXPANDER

The MCP23S17 device family provides 16-bit, general purpose parallel I/O exopansion for SPI applications.
The MCP23S17 consists of multiple 8-bit configuration registers for input, output and polarity selection. The system master can enable the I/O as either inputs or outputs by writing the I/O configuration bits. The data for each input or output is kept in the corresponding input or output register. The polarity of the Input Port register can be inverted with Polarity Inversion register. All registers can be read by the system master.

In order to enable SPI communication you need to select source pins for SDO, SDI, SCK and CS lines, depending on MCU you are using.

For example, if you are using PIC30F4013 you need to select RF3 pin for SDO line, RF2 pin for SDI line and RF6 pin for SCK line. For CS line, you can choose RB5, RB7 or RB8 pin.

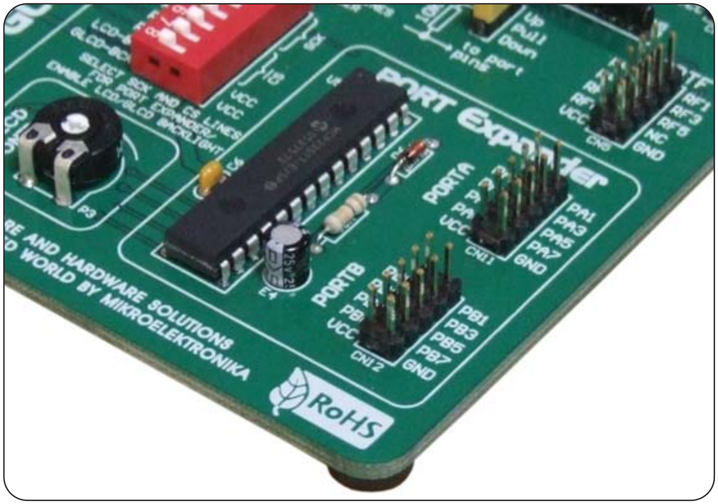


Figure 32. Port Expander

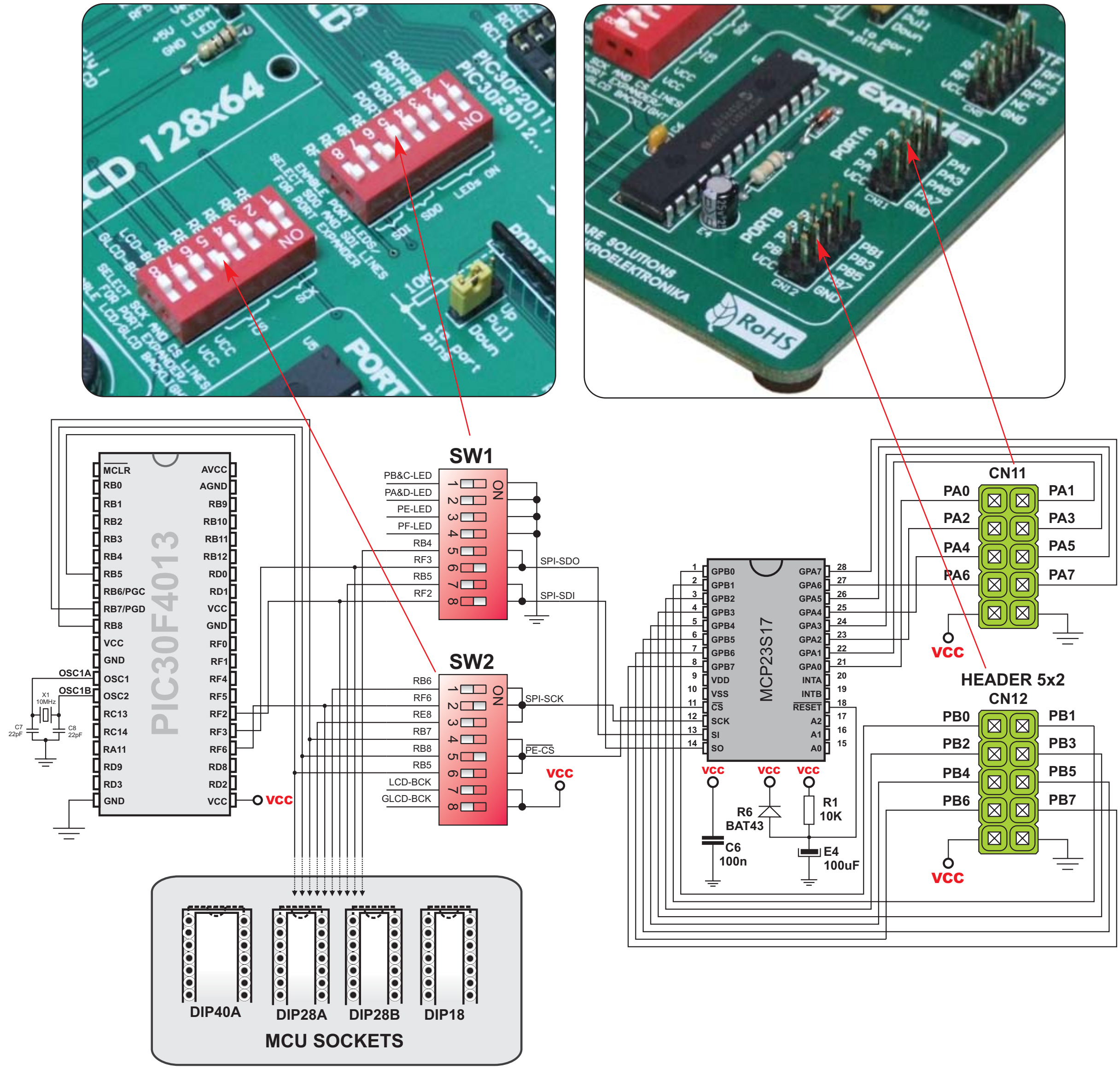


Figure 33. Port Expander schematic

ICD2 (IN-CIRCUIT DEBUGGER) CONNECTOR

The ICD2 is low-cost In-Circuit Debugger (ICD) and In-Circuit Serial Programmer (ICSP). ICD2 is intended to be used as an evaluation, debugging and programming aid in a laboratory enviroment.

The ICD2 offers these features:

- Real-time and single-step code execution
- Breakpoints, Register and Variable Watch/Modify
- In-Circuit Debugging
- Target VCC monitor

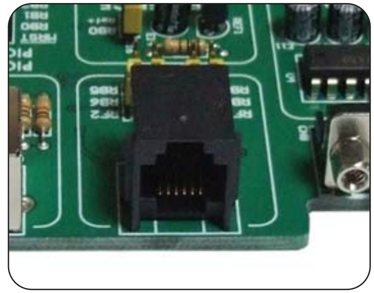


Figure 34. ICD2 Connector

Note: There are two jumper groups J10 and J11. J10 connects RF2, RB6 and RB5 pin to PGC line on ICD2 connector. J11 connects RF3, RB7 and RB4 pin to PGD line on ICD2 connector

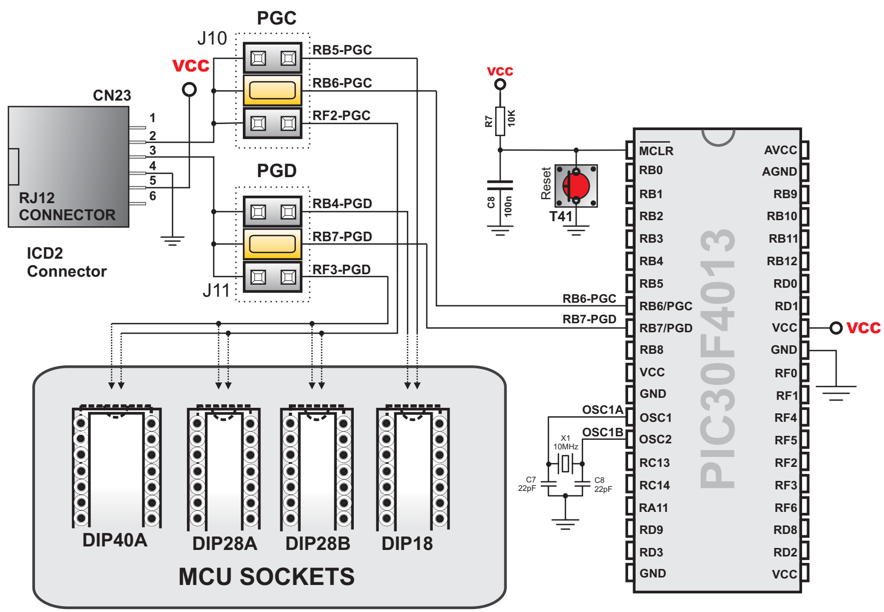


Figure 35. ICD2 Connector schematic

First edition
May 2007

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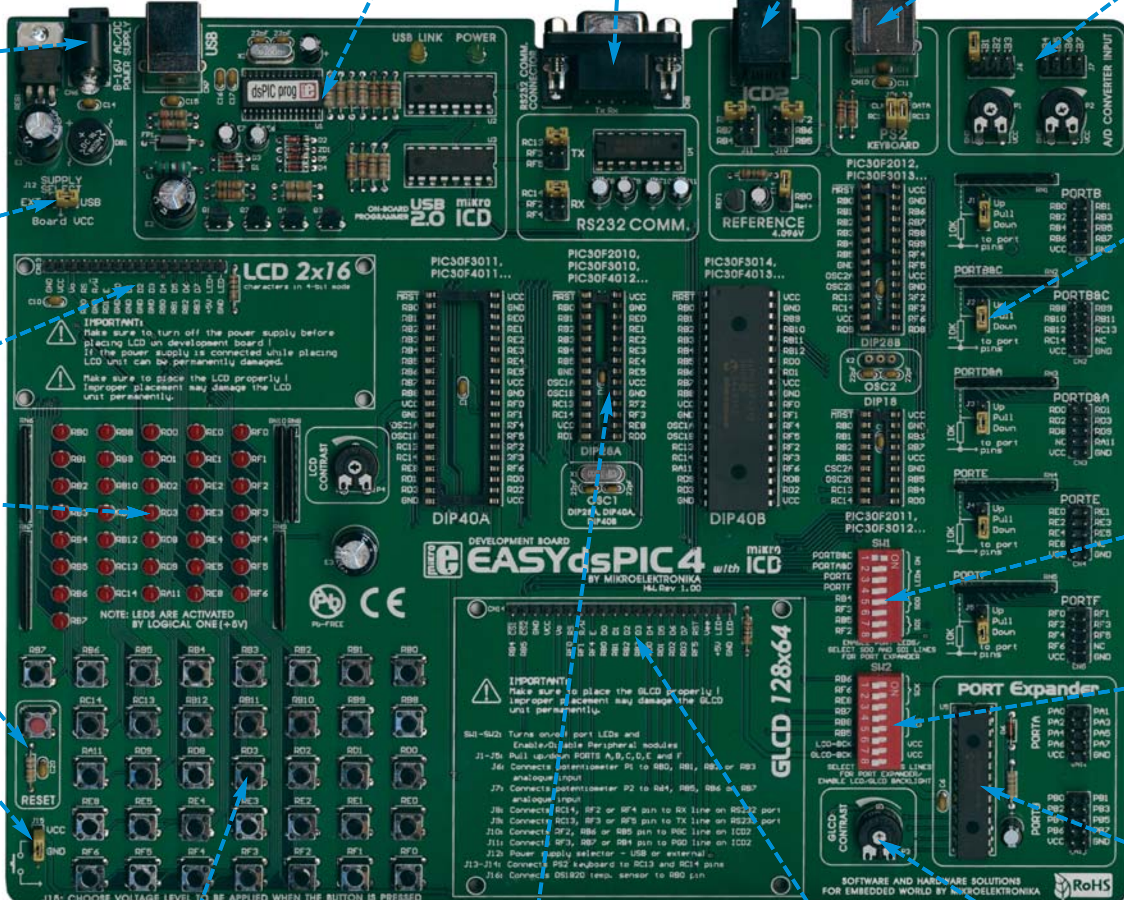
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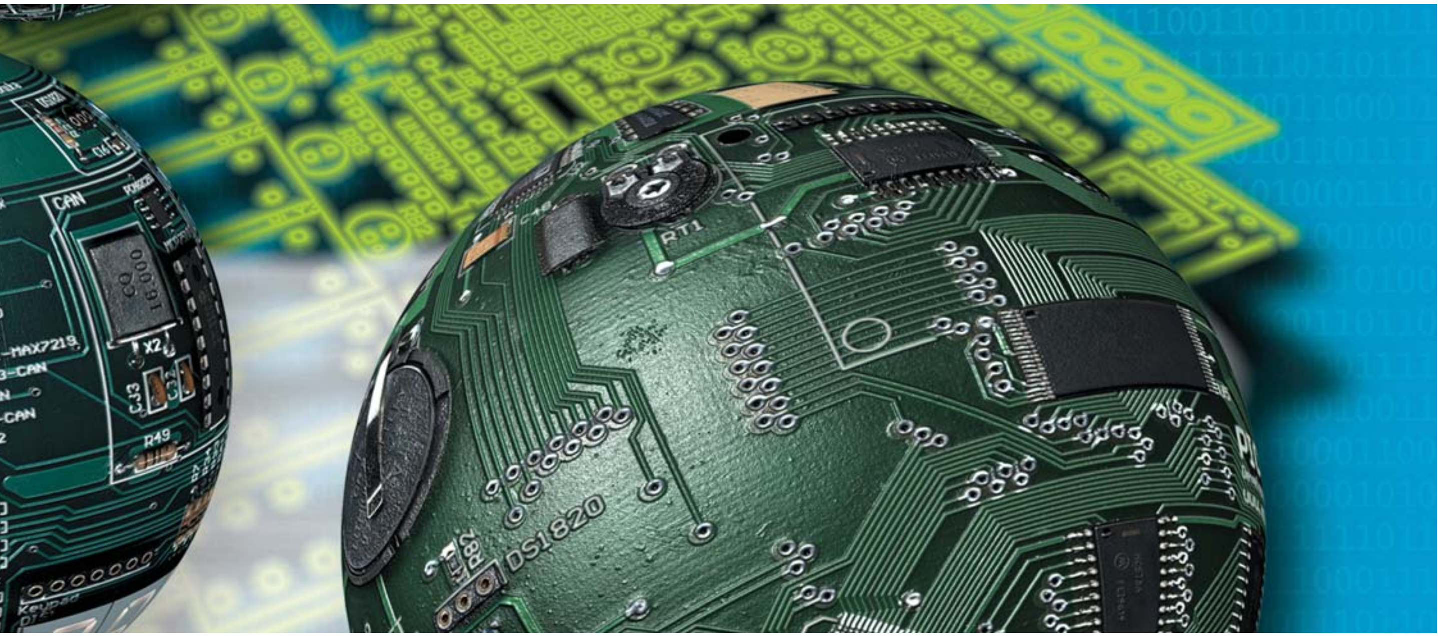
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